FORM PTO-1390 REV. 5-93	US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEYS DOCKET NUMBER P00,1979
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/763033
INTERNATIONAL APPLICATION NO. PCT/DE99/02578	INTERNATIONAL FILING DATE 17 AUGUST 1999	PRIORITY DATE CLAIMED 17 AUGUST 1998

TITLE OF INVENTION

ERROR CANCELLATION IN THE SWITCHING DEVICE OF A COMMUNICATION SYSTEM

APPLICANT(S) FOR DO/EO/US

JOHANNES WOLLENWEBER ET AL.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report, References).**
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Amendment "A" Prior to Action.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification and substitute specification mark-up.
15. ☒ A change of address letter attached to the Declaration.
16. ☒ Other items or information:
    a. ☒ Submission of drawings
    b. ☒ EXPRESS MAIL #EL655300916US dated February 15, 2001

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/763033	PCT/DE99/02578	P00,1979

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $860.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) . . $690.00		
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $710.00		
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1000.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) . . . . . $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	10	- 20 =	0	X $ 18.00	$	
Independent Claims	02	- 3 =	0	X $ 80.00	$	
Multiple Dependent Claims				$270.00+	$	
TOTAL OF ABOVE CALCULATIONS =					$ 860.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
SUBTOTAL =					$ 860.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$	
TOTAL NATIONAL FEE =					$ 860.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +						
TOTAL FEES ENCLOSED =					$ 860.00	
					Amount to be refunded	$
					charged	$

a. ☒ A check in the amount of $ 860.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **50-1519**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SCHIFF HARDIN & WAITE
PATENT DEPARTMENT
6600 Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606-6473
CUSTOMER NUMBER 26574

Steve H. Noll
SIGNATURE

Steve H. Noll
NAME

28,982
Registration Number

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY – CHAPTER II

AMENDMENT "A" PRIOR TO ACTION AND SUBMISSION OF SUBSTITUTE SPECIFICATION

APPLICANT(S):	WOLLENWEBER, J., et al.
ATTORNEY DOCKET NO:	P00,1979
INTERNATIONAL APPLICATION NO:	PCT/DE99/02578
INTERNATIONAL FILING DATE:	17 AUG 1999
INVENTION:	ERROR CANCELLATION IN THE SWITCHING DEVICE OF A COMMUNICATION SYSTEM

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Applicants herewith submit an amendment and substitute specification in the above-referenced PCT application, and respectfully request entry of same prior to examination in the United States National Examination Stage.

IN THE SPECIFICATION

Cancel the specification as filed, and insert therefore the substitute specification provided herewith.

IN THE CLAIMS

Cancel claims 1 – 9 as filed, and insert therefore new claims 10 – 19 as follows:

- - What is claimed is:

10. A method for reversion of a fault in active peripheral assemblies of a communications system switching device, wherein at least one signaled communications link is switched via the active peripheral assemblies and connection data for the communications link is stored in the active peripheral assemblies, the active peripheral assemblies being in communication with central memory devices, the method comprising the steps of:

storing connection data elsewhere in a redundant manner in the central memory devices memory devices;

transmitting the connection data to the active peripheral assemblies after the occurrence of a fault; and

one of, interrupting or starting, transmission of the connection data at a later time in order to allow set-up of new communications links.

11. The method of claim 10, wherein a redundant passive peripheral assemblies is provided for the active peripheral assemblies.

12. The method of claim 11, wherein the active peripheral assemblies is still active after the occurrence of a fault in the software of the active peripheral assemblies.

13. The method of claim 12, wherein after the occurrence of the fault, the previously active peripheral assemblies become passive and redundant assemblies are used as the active peripheral assemblies.

14. The method of claim 13, wherein the connection data to be transmitted remains stored elsewhere.

15. The method of claim 14, further comprising the step of transmitting the connection data in blocks.

16. The method of claim 15, further comprising the steps of:

checking hardware settings which already existed in the active peripheral assemblies on the basis of the connection data after at least partial transmission of the connection data; and

correcting the hardware settings if necessary.

17. The method of claim 16, wherein the communications system is an ATM (Asynchronous Transfer Mode) communications system.

18. A switching device for a communications system, comprising:

a central control unit for controlling a number of associated peripheral assemblies via which communications links can be switched;

the central control unit having a data memory in which connection data for signaled communications link which are switched via the associated peripheral assemblies can be stored; and

a unit for receiving and transmitting the connection data to the associated peripheral assemblies, whereby a connection manager in the associated peripheral assemblies one of, interrupts transmission of the

connection data or starts transmission of the connection data, at a later time in order to allow set-up of new communications links.

19. The switching device of claim 18, wherein the communications system is an ATM (Asynchronous Transfer Mode) communications system. - -

IN THE ABSTRACT

Cancel the Abstract as filed, and insert therefore on a separate page, the following Abstract of the Disclosure:

- - **ABSTRACT OF THE DISCLOSURE**

A method and apparatus for fault reversion in a communications system switching device, wherein after occurrence of a fault, connection data which has been previously stored elsewhere in a redundant manner is used to handle communication links in the system. The method and apparatus involves a switching device having a central control unit including a data memory. Connection data, which can be switched via associated peripheral assemblies, is received from signaled communications links and stored in the data memory. - -

REMARKS

A substitute specification and an Abstract of the Disclosure are provided herewith which make editorial changes in order to conform to standard US practice. A marked-up copy of the specification is also provided reflecting the changes made.

In addition, the claims as filed have been canceled and replaced by new claims that more clearly set forth the subject matter of Applicants' invention.

No new matter has been inserted into the application.

Applicants submit that this application is In proper condition for examination in the United States National Examination Stage, which action is earnestly solicited.

Respectfully submitted,

Steven H. Noll (Reg. No. 28,982)

SCHIFF, HARDIN & WAITE
Patent Department
6600 Sears Tower
233 South Wacker Drive
Chicago, IL 60606
Telephone (312) 258-5790
Attorney for Applicant(s)
CUSTOMER NUMBER 26574

Description

Fault reversion in a switching device of a communications system

The invention relates to a method for reversion of a fault in an active peripheral assembly of a switching device in a communications system, in particular in an ATM (Asynchronous Transfer Mode) communications system, in which at least one signaled communications link is switched via the active peripheral assembly, and in which connection data for the communications link are stored in the active peripheral assembly in order to handle the communications link. The invention furthermore relates to a switching device for a communications system, in particular for an ATM communications system, having a central control unit for controlling a number of associated peripheral assemblies via which communications links can be switched.

It is known in switching devices of communications systems for communications links to be switched via peripheral assemblies of a switching device, that is to say to handle the communications links with the aid of hardware components of the peripheral assemblies, in particular to set up, to maintain and to end such links. Furthermore, it is known for a number of peripheral assemblies to be controlled via a central switching-internal computer. The central computer transmits, in particular, signals relating to the setting up and clearing of communications links, to the peripheral assemblies.

From ATM communications technology, it is known for permanent and signaled communications links to be set up and to be maintained. The permanent communications links are normally set up and maintained over lengthy time periods by the operator of a communications

system. Permanent communications links are subject to particularly stringent reliability requirements.

Signaled communications links are produced on request by the operator or by a user of the communications system and, as a rule, are maintained for shorter time periods than the permanent communications links. For example, a signaled communications link is ended when a telephone handset is placed on the rest. A typical feature of a signaled communications link is that it is left to the communications system to decide which chain of a number of possible physical path elements for transmission of communications signals will be set up for the signaled communications link.

It is furthermore known for signaled permanent communications links to be set up and to be maintained over a similarly lengthy time period as permanent communications links. Signaled permanent communications links are subject to similarly stringent reliability requirements as permanent communications links. In contrast to permanent communications links, the operator or a user of the communications system specifies only some of the nodes in the communications system and/or only some of the physical transmission sections, via which the communications link is intended to be set up, when setting up a signaled permanent communications link. Apart from this, the setting up of a signaled permanent communications link is left to the communications system. As in the case of signaled communications links as well, signaled permanent communications links require additional connection data and/or connection data of a different type to be stored, in comparison with the data for permanent communications links, in order to handle the communications links.

In order to allow faults in an active peripheral assembly to be reversed, it is known for redundant peripheral assemblies and/or redundant transmission paths to be provided. If a peripheral assembly or a transmission path fails, the communications link or the communications links is or are routed to the redundant peripheral assembly and/or transmission path. In this case, a distinction is drawn between different types of redundancy. For example, peripheral assemblies may have so-called 1+1 redundancy or 1:N redundancy.

In the case of 1+1 redundancy, a passive peripheral assembly is provided for an individual active peripheral assembly and is available exclusively as a standby assembly for that active peripheral assembly. In consequence, the passive, redundant assembly may contain essentially the same hardware and software settings as the active assembly. In practice however, the software settings in particular, that is to say, for example, the connection data stored in the assembly, change at short time intervals. The software for the passive, redundant assembly is thus not reliably at the latest standard, so that it is not possible to switch over from the active assembly to the passive assembly without updating the software and/or the connection data. Furthermore, there is no assurance that the same hardware settings would exist at the same time in both assemblies. For this reason, loss of all the signaled communications links must be expected if it is also possible for some of these signaled communications links to be maintained. Furthermore, when switching over from an active transmission path to a 1+1 redundant transmission path, it may be necessary to switch a number of peripheral assemblies which each have 1+1 redundancy. This increases the probability that the majority, or all the signaled communications links, will be lost.

In the case of 1:N redundancy, there is only one joint redundant assembly where the number of assemblies is N > 1. Presets in the redundant assembly, which speed up switching from one of the N active assemblies to the redundant assembly, which ensure that existing signaled communications links are maintained, thus cannot be carried out, or can be carried out only to a limited extent, according to the known method.

When software faults occur in an active peripheral assembly, it is known for the entire assembly to be reset and to be restarted. In the process, all the connection data for signaled communications links are deleted, so that all these communications links are terminated.

The present invention is based on the object of specifying a method for reversion of a fault in an active peripheral assembly of the type mentioned initially, in which stable signaled communications links can be reliably maintained after the occurrence of the fault. A further object of the invention is to specify a corresponding switching device.

The objects are respectively achieved by a method having the features of claim 1, and by an apparatus having the features of claim 10. Developments are the subject matter of the dependent claims.

With regard to the method, the connection data for the at least one communications link, which data are stored in the active peripheral assembly, are also stored elsewhere in a redundant manner. After the occurrence of the fault, the connection data which are stored elsewhere in a redundant manner are used in order to continue to handle the communications link. The storage of two up-to-date sets of connection data ensures that the connection data are still available, at least once, after the failure or after the occurrence of the fault in the active peripheral assembly. Provided the redundant set of connection data, or at least one of the redundant sets of

connection data, is or are undamaged after the occurrence of the fault, the undamaged data set can be used to continue to handle the communications link. It is thus possible to maintain the at least one signaled communications link, provided it is still stable after the occurrence of the fault. In order to preclude the possibility of the set of data which is stored in the faulty peripheral assembly being damaged and thus endangering the maintenance of the at least one communications link when it is used further, the connection data stored in the faulty peripheral assembly are preferably deleted.

The method according to the invention has the advantage that signaled communications links can be maintained with the same reliability as permanent communications links, which may be unstable in the same way as the signaled communications links after the occurrence of the fault, or can no longer be maintained owing to the fault.

The term peripheral assembly means an assembly or unit of a switching device which is directly involved in the setting up and/or in the maintenance of a communications link. The term peripheral assemblies covers, in particular, interface assemblies (Line Interface Cards LIC), which form an interface to transmission lines outside the switching system, multiplexer units (for example Statistical Multiplexing Units SMU) which connect a number of interface assemblies to a switching network, switching networks (ATM Switching Networks ASN) which produce the correct output from a number of possible outputs in response to signals arriving at them. In particular, the assemblies have a large number of elements which carry out functions on the assembly, but at least a memory area for storing the

connection data and an element which is directly involved in the communications link. The invention can also be used in other communications system, for example in STM (Synchronous Transfer Mode) communications systems.

In a communications system, the term switching device means a device which allows various switching-system-external and/or switching-system-internal transmission paths or transmission lines to be connected to one another or to be enabled for the purposes of setting up a communications link.

The term communications link means a link for connection of any desired type via which signals can be transmitted within the communications system or beyond the boundaries of the communications system.

The connection data are preferably stored in a memory device which is central for the number of peripheral assemblies, before the fault occurs. In particular, the memory device is part of a central switching computer of the switching device. In this case, the switching computer may, for example, update that copy of the connection data which is stored in its memory device whenever it informs the active peripheral assembly of changes which relate to the connection data.

However, on the other hand, as well, the central memory for the connection data for a number of peripheral assemblies has the advantage that one common memory unit or memory device is sufficient, and that the data administration can be carried out in an effective manner.

In one development, a redundant passive peripheral assembly, in which the connection data are stored in a redundant manner, is provided for the active peripheral assembly. In contrast to the prior art, the passive peripheral assembly is used to store a set of connection data which is just as up-to-date as that in

the active peripheral assembly. This firstly creates the possibility simply of switching over to the passive peripheral assembly after the occurrence of the fault in the active peripheral assembly while, on the other hand, it is possible to transmit the connection data from the passive peripheral assembly to the active peripheral assembly, for example if the connection data stored in the active peripheral assembly are faulty, or there is a possibility of such data being faulty.

If a fault occurs in the software of the active peripheral assembly, the connection data which are stored elsewhere in a redundant manner can be transmitted, in a preferred manner, to the peripheral assembly which is still active after the occurrence of the fault. Faults in software covers not only faults in programs, but also faults in stored data to which access can be made while a program is running.

In many fault situations, continuation of operation of the active peripheral assembly represents the fastest and most reliable option for maintaining stable communications links without considerable interruptions. Mostly, hardware settings still exist in the active peripheral assembly in order to maintain a communications link after the occurrence of the fault. This is preferably checked after the transmission of the connection data stored elsewhere in a redundant manner, or at least after transmission of some of these connection data items. During the check it is also, for example, possible to confirm whether the connection data stored elsewhere in a redundant manner have been changed as a consequence of their having been updated in the meantime, so that corresponding corrections or changes are required to the hardware settings. One possible reason for this occurs when a message that the communications link is intended to be ended arrives at a central switching computer in the meantime.

In one preferred refinement of the method, the connection data to be transmitted remain stored at the other location, that is to say they are transmitted in the form of a copy. This also applies in particular to the situation in which, after the occurrence of the fault, the previously active peripheral assembly becomes passive and a redundant assembly is used as the active peripheral assembly, to which the connection data stored elsewhere in a redundant manner are transmitted. This method variant makes it possible to maintain stable communications links in particular when hardware faults occur in the previously active peripheral assembly.

In one particularly preferred development of the method, the transmission of the connection data to the peripheral assembly which is active after the occurrence of the fault is interrupted, or is not started until later, in order to allow the setting up of new communications links. In this case, expediently, the connection data to be transmitted are transmitted in blocks to the active peripheral assembly. One major advantage of this development is that, as soon as it is confirmed which peripheral assembly will be taking over or continuing the active operation after the occurrence of the fault, new communications links can be set up, and in this case it is possible to use the same method as that for fault-free operation.

With regard to the apparatus, the object of the invention as stated above is achieved in that the central control unit of the switching device has a data memory in which connection data can be stored from signaled subscriber connections which are switched via the associated peripheral assemblies, and in that a transmission unit is provided for reading and transmitting the connection data to the associated peripheral assemblies. Advantages and developments result from the above description of the method according to the invention, and its developments.

Exemplary embodiments of the invention will now be described with reference to the attached drawing. However, the invention is not limited to these exemplary embodiments. The single figure of the drawing, which is annotated Figure 1, shows:

a switching device having two 1+1 redundant interface assemblies during reversion of a fault.

The switching device EXC (shown in Figure 1) of a communications system has two interface assemblies LIC1, LIC2 which are 1+1 redundant with respect to one another. A large number of communications links are set up, maintained and/or ended via the respective active interface assembly LIC1, LIC2. For this purpose, connections (which are not shown) of the interface assemblies LIC1, LIC2 are connected to external subsections (which are likewise not shown) of transmission lines for transmission of communications signals. Within the switching system, the interface assemblies LIC1, LIC2 are connected to additional assemblies (which are also not shown) of the switching device EXC. The communications signals arriving at and/or departing from the active interface assembly LIC1, LIC2 can be transmitted on defined sections of communications lines via these assemblies, for example multiplexer assemblies, switching network assemblies and other interface assemblies.

The fault reversion described in the following text can also be carried out in a corresponding manner for the said types and further types of peripheral assemblies for a switching device. In a first exemplary embodiment for fault reversion, a software fault has occurred in the peripheral assembly LIC2. In order to circumvent the fault, the interface assembly LIC2 is reset, and all the data that are not stored in permanent memories are lost.

This effect is desirable since it ensures that faulty data are deleted. The effort for precise localization of faulty components of data which are not faulty overall is generally considerably greater than this.

After the resetting of the interface assembly LIC2, basic data are first of all transferred or transmitted from a database manager DBMS of a central switching computer MP to a database CDB of the interface assembly LIC2. In the process, it is possible to transmit, in particular, data for programs which are used to carry out the functions of the peripheral assembly LIC2. Alternatively or additionally, a permanent memory, for example an FEPROM, is provided in the peripheral assembly LIC2, in which program data are stored and from which, after resetting, data are copied to a volatile memory, for example a RAM, which contains the database CDB. It has already been proposed that, in method step a, data be transmitted from permanent communications links to the interface assembly LIC2 which are stored in a redundant manner in the central switching computer MP. It is also known, once method step a has been carried out, for hardware settings relating to the connection hardware ASIC of the interface assembly LIC2 to be checked for consistency with the data of the permanent communications links, and for any corrections which may be necessary to the hardware settings to be carried out. The connection manager COH of the interface assembly LIC2 is involved in this activity, in that it reads the data from the database CDB and carries out the appropriate test steps.

Now, in method step b, connection data, which are stored in a redundant manner in the central switching computer MP, for the signaled communications links are transmitted to the interface assembly LIC2, which is being or has been maintained with the aid of the connection hardware ASIC in the interface assembly LIC2.

In the process, it is possible for individual signaled communications links, or for a number of signaled communications links, to be interrupted or terminated as a result of the fault which has occurred. In method step b, a switching data manager RHS in the central switching computer MP transmits the connection data for the signaled communications links to the connection manager COH in the interface assembly LIC2. In the process, the connection data are transmitted in data blocks of predetermined length. It takes the connection manager COH a period of 5ms, for example, to receive a data block, with connection data being received for about 30 signaled communications links for the interface assembly LIC2. After reception of the data block, the connection manager COH starts to check the hardware settings of the corresponding communications links, which are carried out in the connection hardware ASIC (method step d). It takes the connection manager COH, for example, about half a second to read the connection data and to check them for consistency with the hardware settings for about 30 communications links.

Method step b' is carried out in parallel with method step b). In method step b', the connection manager COH is informed by the connection data manager RHS when a request to set up a new communications link is present in the central switching computer MP. Before the transmission of the first data block in method step b, or between the transmission of two data blocks, the connection manager COH reacts to the request by setting up a new communications link on the basis of the connection data which it receives from the connection data manager RHS together with the information about the presence of the request. The new communications link may be a signaled communications link or a non-signaled communications link. Corresponding procedures are used in the presence of requests to set up a number of new

communications links. In this case, the corresponding data can be transmitted individually or in blocks to the connection manager COH. The requests for new communications links preferably have priority over the checking of the hardware settings of already existing communications links, so that they are processed with priority by the connection manager COH. Furthermore, however, a time interval of predetermined length is preferably provided after which, at the latest, the connection manager COH again receives connection data from existing communications links, or continues with checking the hardware settings of communications links whose connection data it already has. For example, during operation of communications systems in practice, it is accepted that the setting up of requested new communications links in a peripheral assembly will be delayed by around 500ms. As described above, the connection data for approximately 30 already existing communications links, for example, can be read and the corresponding hardware settings checked within 500ms. The checking of the hardware setting is annotated in Figure 1 by the reference symbol d, and the resetting of communications links in the connection hardware HSIC is annotated by the reference symbol d'.

Before, during and after reception of connection data for already existing communications links and/or reception of connection data of communications links to be set up as new, a start pulse for a time-interval measurement for connection-duration-dependent charges is in case issued, in a development of the invention. If the connection manager COH has the respective connection data for such a communications link, it sends the start pulse to the charge meter TM which is provided in the interface assembly LIC2. The transmission of the charge-meter start pulse for already existing communications links is illustrated as method step c, and the corresponding

transmission of a start pulse for a communications link which is to be set up as new is shown as method step c'.

In yet another development of the exemplary embodiment described with reference to Figure 1 for the method according to the invention, the central switching computer MP transmits a request to the connection manager COH to terminate an existing communications link, in a method step (which is not shown) after method step a. However, in the development of the exemplary embodiment, the charge-meter start pulse according to method step c has not yet been transmitted from the connection manager COH to the charge meter TM at this time. The connection manager COH thus does not confirm the request, and does not act on this request either. This ensures that the charge meter TM can determine the connection-duration-dependent charges correctly and does not receive a charge-meter stop pulse before receiving a charge-meter start pulse for an existing communications link. Since the central switching computer MP have not received any confirmation from the connection manager COH, it repeats the transmission of the request to terminate the communications link, preferably at time intervals which are fixed in advance. In the meantime, for example between the first and the third transmission of the request, the connection manager COH will have received the connection data for the relevant communications link, and will have sent a corresponding charge-meter start pulse to the charge meter TM. This thus acknowledges the third request with a confirmation, sends a charge-meter stop pulse to the charge meter TM, and terminates the communications link by making appropriate hardware settings in the connection hardware ASIC.

In the exemplary embodiment described so far, it has been assumed that there has been a software fault in the interface assembly LIC2. The same method, together with its development, can, however, be applied, for

example, to a situation in which a hardware fault has occurred in the previously active interface assembly LIC1 and the 1+1 redundant interface assembly LIC2 has taken over the active function from the interface assembly LIC1. Furthermore, the same refinements of the method can be used in situations in which there is no redundant component or in which 1:N redundancy exists. Overall, a universal method is thus available for reversion of a fault in an active peripheral assembly in a switching device, which allows all those communications links which are stable after the occurrence of the fault to be maintained while having to accept, at worst, only short interruption times. Furthermore, the universal method ensures the setting up of communications links as new with the least possible time delay while reliably deleting all possibly faulty data in the assembly.

New Patent Claims

1. A method for reversion of a fault in an active peripheral assembly (LIC1, LIC2) of a switching device (EXC) in a communications system, in particular in an ATM (Asynchronous Transfer Mode) communications system, in which at least one signaled communications link is switched via the active peripheral assembly (LIC1, LIC2), and in which connection data for the communications link are stored in the active peripheral assembly (LIC1, LIC2) in order to handle the communications link, and in which case, after the occurrence of the fault, the connection data which are stored in a redundant manner in memory devices (RHS) which are central for a number of peripheral assemblies (LIC1, LIC2) are transmitted to the active peripheral assembly (LIC1, LIC2),
characterized
in that the transmission of the connection data is interrupted or is started at a later time, in order to allow the setting up of new communications links.

2. The method as claimed in claim 1,
characterized
in that the connection data are stored in the memory device (RHS), which is central for a number of peripheral assemblies (LIC1, LIC2), before the occurrence of the fault.

3. The method as claimed in claim 1 or 2,
characterized
in that a redundant passive peripheral assembly (LIC2), in which the connection data are stored in a redundant manner, is provided for the active peripheral assembly (LIC1).

4. The method as claimed in one of claims 1 to 3, in which a fault occurs in the software of the active peripheral assembly (LIC2), characterized in that the active peripheral assembly (LIC2) is still active after the occurrence of the fault.

5. The method as claimed in one of claims 1 to 3, characterized in that, after the occurrence of the fault, the previously active peripheral assembly (LIC1) becomes passive, and a redundant assembly is used as the active peripheral assembly (LIC2), to which the connection data which are stored in a redundant manner elsewhere are transmitted.

6. The method as claimed in claim 4 or 5, characterized in that the connection data to be transmitted remain stored at the other location.

7. The method as claimed in one of claims 1 to 6, characterized in that the connection data to be transmitted are transmitted in blocks to the active peripheral assembly (LIC2).

8. The method as claimed in one of claims 1 to 7, characterized in that, after the at least partial transmission of the connection data, hardware settings which already exist in the active peripheral assembly (LIC2) are checked on the basis of the received connection data, and are corrected if necessary.

9. A switching device (EXC) for a communications system, in particular for an ATM communications system, having a central control unit (MP) for controlling a number of associated peripheral assemblies (LIC1, LIC2) via which communications links can be switched, in which case the central control unit (MP) has a data memory in which connection data for signaled communications links which are switched via the associated peripheral assemblies (LIC1, LIC2) can be stored, and wherein a transmission unit (RHS) is provided for reading and transmitting the connection data to the associated peripheral assemblies (LIC, LIC2), characterized in that a connection manager (COH) in the associated peripheral assemblies (LIC1, LIC2) interrupts the transmission of the connection data, or starts such transmission at a later time, in order to allow new communications links to be set up.

Abstract

Fault reversion in a switching device of a communications system

After the occurrence of the fault, the connection data which are stored in a redundant manner elsewhere are used to handle a communications link further. The invention further relates to a switching device (EXC) in whose central control unit (MP) a data memory is provided in which connection data can be stored from signaled communications links which are switched via the associated peripheral assemblies (LIC1, LIC2).

Figure 1

Substitute Specification:

- - METHOD AND APPARATUS FOR FAULT REVERSION IN A COMMUNICATIONS SYSTEM SWITCHING DEVICE

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention pertains to a method and apparatus for reversion of a fault in an active peripheral assembly of a switching device in a communications system. In particular, the present invention pertains to a method and apparatus for reversion of a fault in an active peripheral assembly of a switching device in an ATM (Asynchronous Transfer Mode) communications system.

Discussion of the Related Art:

It is known in switching devices of communications systems for communications links to be switched via peripheral assemblies of a switching device, that is to say to handle the communications links with the aid of hardware components of the peripheral assemblies, in particular to set up, to maintain and to end such links. Furthermore, it is known for a number of peripheral assemblies to be controlled via a central switching-internal computer. The central computer transmits, in particular, signals relating to the setting up and clearing of communications links, to the peripheral assemblies.

From ATM communications technology, it is known for permanent and signaled communications links to be set up and to be maintained. The permanent communications links are normally set up and maintained over

lengthy time periods by the operator of a communications system. Permanent communications links are subject to particularly stringent reliability requirements.

Signaled communications links are produced on request by the operator or by a user of the communications system and, as a rule, are maintained for shorter time periods than the permanent communications links. For example, a signaled communications link is ended when a telephone handset is placed on the rest. A typical feature of a signaled communications link is that it is left to the communications system to decide which chain of a number of possible physical path elements for transmission of communications signals will be set up for the signaled communications link.

Furthermore, it is known for signaled permanent communications links to be set up and maintained over a similarly lengthy time period as permanent communications links. Signaled permanent communications links are subject to similarly stringent reliability requirements as are permanent communications links. In contrast to permanent communications links, the operator or a user of a signaled permanet communications link communications system specifies only some of the nodes in the communications system and/or only some of the physical transmission sections, via which the communications link is intended to be set up.

Apart from this, setting up of a signaled permanent communications link is left to the communications system. As in the case of signaled communications links, signaled permanent communications links require additional connection data and/or connection data of a different type to be stored, in comparison with

the data for permanent communications links, in order to handle the communications links.

In order to allow faults in an active peripheral assembly to be reversed, redundant peripheral assemblies and/or redundant transmission paths need to be provided. If a peripheral assembly or a transmission path fails, the communications link or links are routed to the redundant peripheral assembly and/or transmission path. In this case, a distinction is drawn between different types of redundancy. For example, peripheral assemblies may have so-called 1+1 redundancy or 1:N redundancy.

In the case of 1+1 redundancy, a passive peripheral assembly is provided for an individual active peripheral assembly and is available exclusively as a standby assembly for that active peripheral assembly. In consequence, the passive, redundant assembly may contain essentially the same hardware and software settings as the active assembly. In practice however, the software settings in particular, such as connection data stored in the assembly, change at short time intervals. The software for the passive, redundant assembly is thus not reliably at the latest standard, so that it is not possible to switch over from the active assembly to the passive assembly without updating the software and/or the connection data.

Furthermore, there is no assurance that the same hardware settings would exist at the same time in both assemblies. For this reason, loss of all the signaled communications links must be expected if it is also possible for some of these signaled communications links to be maintained.

Therefore, when switching over from an active transmission path to a 1+1 redundant transmission path, it may be necessary to switch a number of peripheral assemblies which each have 1+1 redundancy. This increases the probability that the majority, or all the signaled communications links, will be lost. In the case of 1:N redundancy, there is only one joint redundant assembly where the number of assemblies is N > 1. Presets in the redundant assembly, which speed up switching from one of the N active assemblies to the redundant assembly, which ensure that existing signaled communications links are maintained, thus cannot be carried out, or can be carried out only to a limited extent, according to the known method.

When software faults occur in an active peripheral assembly, the entire assembly may need to be reset and restarted. In the process, all the connection data for signaled communications links are deleted, so that all these communications links are terminated.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a method and appratus for reversion of a fault in a communications system.

It is another object of the invention to provide a method and appratus in which stable signaled communications links in a communications system can be reliably maintained after the occurrence of a fault.

It is a further object of the invention to provide a method and apparratus for specifying a corresponding switching device in a communications system after the occurrence of a fault.

It is an additional object of the invention to provide a method and apparatus in an ATM (Asynchronous Transfer Mode) communications system in which at least one signaled communications link is switched via an active peripheral assembly after the occurrence of a fault.

It is yet another object of the invention to provide a method and apparatus in which connection data for communications link on a communications system are stored in an active peripheral assembly.

It is yet a further object of the invention to provide a method and apparatus for an ATM communications system having a central control unit and a number of associated peripheral assemblies via which communications links can be switched.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a switching device according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a switching device EXC having two 1+1 redundant interface assemblies according to the present invention.

The switching device EXC has two interface assemblies LICI, LIC2 which are 1+1 redundant with respect to one another. A large number of

communications links are set up, maintained and/or ended via the respective active interface assemblies LICl, LIC2. For this purpose, connections (not shown) of the interface assemblies LICl, LIC2 is made to external subsections (not shown) of transmission lines for transmission of communications signals.

Within the switching system, the active interface assemblies LIC1, LIC2 are connected to additional assemblies (not shown) of the switching device EXC.

Communications signals arriving at and/or departing from the active interface assembly LICl, LIC2 can be transmitted on defined sections of communications lines via these assemblies, for example, multiplexer assemblies, switching network assemblies and other interface assemblies.

In a first type of fault reversion, let's say a software fault has occurred in the peripheral assembly LIC2. In order to circumvent the fault, the interface assembly LIC2 is reset, and all the data stored in permanent memories is lost.

This effect is desirable since it ensures that faulty data are deleted. The effort for precise localization of faulty components of data which are not faulty overall is generally considerably greater than this.

After resetting of the interface assembly LIC2, basic data are first of all transferred or transmitted from a database manager DBMS of a central switching computer MP to a database CDB of the interface assembly LIC2. In the process, it is possible to transmit, in particular, data for programs which are used to carry out the functions of the peripheral assembly LIC2. Alternatively or additionally, a permanent memory, for example an EEPROM, is provided in the peripheral assembly LIC2, in which program data are stored and from which, after resetting,

data are copied to a volatile memory, for example a RAM, which contains the database CDB.

The method steps of the present invention for reversion of a fault in an active peripheral assembly LIC1or LIC2 of a switching device EXC in a communication system include, switching at least one signaled communications link via the active peripheral assemblies LIC1, LIC2, storing connection data for the communications link in the active peripheral assemblies LIC1, LIC2 in order to handle the communications link, and transmitting to the active peripheral assemblies LIC1, LIC2 connection data stored in a switching data manager RHS after occurrence of the fault.

The data manager RHS is central to a number of peripheral assemblies LIC1, LIC2, and the connection data held by the memory devices RHS is stored in a redundant manner.

According to the method of the present invention, transmission of the connection data can be interrupted or started at a later time, in order to allow the setting up of new communications links.

Data is transmitted from permanent communications links to the interface assembly LIC2 which are stored in a redundant manner in the central switching computer MP. Hardware settings relating to the connection hardware ASIC of the interface assembly LIC2 can be checked for consistency with the data of the permanent communications links, and for any corrections which may be necessary to the hardware settings to be carried out. The connection manager

COH of the interface assembly LIC2 is involved in this activity, in that it reads the data from the database CDB and carries out the appropriate test steps.

Connection data, which are stored in a redundant manner in the central switching computer MP, for the signaled communications links are transmitted to the interface assembly LIC2, which is being or has been maintained with the aid of the connection hardware ASIC in the interface assembly LIC2.

In the process, it is possible for individual signaled communications links, or for a number of signaled communications links, to be interrupted or terminated as a result of the fault which has occurred. A switching data manager RHS in the central switching computer MP transmits the connection data for the signaled communications links to the connection manager COR in the interface assembly LIC2. In the process, the connection data are transmitted in data blocks of predetermined length. It takes the connection manager COH a period of 5ms, for example, to receive a data block, with connection data being received for about 30 signaled communications links for the interface assembly LIC2.

After reception of the data block, the connection manager COH starts to check the hardware settings of the corresponding communications links, which are carried out in the connection hardware ASIC. It takes the connection manager COH, for example, about half a second to read the connection data and to check them for consistency with the hardware settings for about 30 communications links.

The connection manager COH is informed by the connection data manager RHS when a request to set up a new communications link is present in

the central switching computer MP. Before the transmission of the first data block, or between the transmission of two data blocks, the connection manager COH reacts to the request by setting up a new communications link on the basis of the connection data which it receives from the data manager RHS together with the information about the presence of the request.

The new communications link may be a signaled communications link or a non-signaled communications link. Corresponding procedures are used in the presence of requests to set up a number of new communications links. In this case, the corresponding data can be transmitted individually or in blocks to the connection manager COH. The requests for new communications links preferably have priority over the checking of the hardware settings of already existing communications links, so that they are processed with priority by the connection manager COH. Furthermore, however, a time interval of predetermined length is preferably provided after which, at the latest, the connection manager COH again receives connection data from existing communications links, or continues with checking the hardware settings of communications links whose connection data it already has. During operation of communications systems in practice, it is accepted that the setting up of requested new communications links in a peripheral assembly will be delayed by around 500ms.

As described above, the connection data for approximately 30 already existing communications links can be read and the corresponding hardware settings checked within 500ms. The checking of the hardware setting is

annotated in Figure 1 by the reference symbol d, and the resetting of communications links in the connection hardware HSIC is annotated by the reference symbol d'.

Before, during and after reception of connection data for already existing communications links and/or reception of connection data of communications links to be set up as new, a start pulse for a time-interval measurement for connection-duration-dependent charges is in case issued, in a development of the invention. If the connection manager COH has the respective connection data for such a communications link, it sends the start pulse to the charge meter TM which is provided in the interface assembly LIC2. The transmission of the charge-meter start pulse for already existing communications links is illustrated as method step c, and the corresponding transmission of a start pulse for a communications link which is to be set up as new is shown as method step c'.

In another embodiment described with reference to Figure 1, the central switching computer MP transmits a request to the connection manager CON to terminate an existing communications link.

However, the charge-meter start pulse according to method step c has not yet been transmitted from the connection manager CON to the charge meter TM at this time. The connection manager COH thus does not confirm the request, and does not act on this request either. This ensures that the charge meter TM can determine the connection-duration-dependent charges correctly and does not receive a charge-meter stop pulse before receiving a charge-meter start pulse for an existing communications link. Since the central switching computer

MP have not received any confirmation from the connection manager COH, it repeats the transmission of the request to terminate the communications link, preferably at time intervals which are fixed in advance. In the meantime, for example between the first and the third transmission of the request, the connection manager COH will have received the connection data for the relevant communications link, and will have sent a corresponding charge-meter start pulse to the charge meter TM.

This acknowledges the third request with a confirmation, sends a charge-meter stop pulse to the charge meter TM, and terminates the communications link by making appropriate hardware settings in the connection hardware ASIC.

In the embodiments described so far, it has been assumed that there has been a software fault in the interface assembly LIC2. The same method, together with its development can be applied, for example, to a situation in which a hardware fault has occurred in the previously active interface assembly LICI and the 1+1 redundant interface assembly LIC2 has taken over the active function from the interface assembly LICI. Furthermore, the method can be used in situations in which there is no redundant component or in which 1:N redundancy exists. Overall, a universal method is thus available for reversion of a fault in an active peripheral assembly in a switching device, which allows all those communications links which are stable after the occurrence of the fault to be maintained while having to accept, at worst, only short interruption times. Furthermore, the universal method ensures the setting up of communications

links as new with the least possible time delay while reliably deleting all possibly faulty data in the assembly.

According to the present invention, connection data for at least one communications link, which data are stored in the active peripheral assembly, are also stored elsewhere in a redundant manner. After the occurrence of the fault, the connection data which are stored elsewhere in a redundant manner are used in order to continue to handle the communications link. Storage of two up-to-date sets of connection data ensures that the connection data are still available, at least once, after the failure or after the occurrence of the fault in the active peripheral assembly. Provided the redundant set of connection data, or at least one of the redundant sets of connection data, is or are undamaged after the occurrence of the fault, the undamaged data set can be used to continue to handle the communications link.

It is thus possible to maintain the at least one signaled communications link, provided it is still stable after the occurrence of the fault. In order to preclude the possibility of the set of data which is stored in the faulty peripheral assembly being damaged and thus endangering the maintenance of the at least one communications link when it is used further, the connection data stored in the faulty peripheral assembly are preferably deleted.

According to the present invention, signaled communications links can be maintained with the same reliability as permanent communications links, which may be unstable in the same way as the signaled communications links after the occurrence of the fault, or can no longer be maintained owing to the fault.

The present invention can also be used in other communications system, for example in STM (Synchronous Transfer Mode) communications systems.

The term peripheral assembly means an assembly or unit of a switching device which is directly involved in the setting up and/or in the maintenance of a communications link. The term peripheral assemblies covers, in particular, interface assemblies (Line Interface Cards LIC), which form an interface to transmission lines outside the switching system, multiplexer units (for example Statistical Multiplexing Units SMU) which connect a number of interface assemblies to a switching network, switching networks (ATM Switching Networks ASN) which produce the correct output from a number of possible outputs in response to signals arriving at them. In particular, the assemblies have a large number of elements which carry out functions on the assembly, but at least a memory area for storing the connection data and an element which is directly involved in the communications link.

In a communications system, the term switching device means a device which allows various switching-system-external and/or switching-system-internal transmission paths or transmission lines to be connected to one another or to be enabled for the purposes of setting up a communications link.

The term communications link means a link for connection of any desired type via which signals can be transmitted within the communications system or beyond the boundaries of the communications system.

The connection data are preferably stored in a memory device which is central for the number of peripheral assemblies, before the fault occurs. In

particular, the memory device is part of a central switching computer of the switching device. In this case, the switching computer may, for example, update that copy of the connection data which is stored in its memory device whenever it informs the active peripheral assembly of changes which relate to the connection data.

However, the central memory for the connection data for a number of peripheral assemblies has the advantage that one common memory unit or memory device is sufficient, and that the data administration can be carried out in an effective manner.

In one development, a redundant passive peripheral assembly, in which the connection data are stored in a redundant manner, is provided for the active peripheral assembly. In contrast to the prior art, the passive peripheral assembly is used to store a set of connection data which is just as up-to-date as that in the active peripheral assembly. This firstly creates the possibility simply of switching over to the passive peripheral assembly after the occurrence of the fault in the active peripheral assembly while, on the other hand, it is possible to transmit the connection data from the passive peripheral assembly to the active peripheral assembly, for example if the connection data stored in the active peripheral assembly are faulty, or there is a possibility of such data being faulty.

If a fault occurs in the software of the active peripheral assembly, the connection data which are stored elsewhere in a redundant manner can be transmitted, in a preferred manner, to the peripheral assembly which is still active after the occurrence of the fault. Faults in software covers not only faults in

programs, but also faults in stored data to which access can be made while a program is running.

In many fault situations, continuation of operation of the active peripheral assembly represents the fastest and most reliable option for maintaining stable communications links without considerable interruptions. Mostly, hardware settings still exist in the active peripheral assembly in order to maintain a communications link after the occurrence of the fault. This is preferably checked after the transmission of the connection data stored elsewhere in a redundant manner, or at least after transmission of some of these connection data items.

During the check it is also, for example, possible to confirm whether the connection data stored elsewhere in a redundant manner have been changed as a consequence of their having been updated in the meantime, so that corresponding corrections or changes are required to the hardware settings. One possible reason for this occurs when a message that the communications link is intended to be ended arrives at a central switching computer in the meantime.

Connection data to be transmitted remains stored at the other location, that is to say they are transmitted in the form of a copy. This also applies to situations in which, after the occurrence of the fault, previously active peripheral assembly become passive and a redundant assembly is used as the active peripheral assembly, to which the connection data stored elsewhere in a redundant manner are transmitted. Thus, it is possible to maintain stable

communications links in particular when hardware faults occur in the previously active peripheral assembly.

Transmission of the connection data to the peripheral assembly which is active after the occurrence of the fault is interrupted, or is not started until later, in order to allow the setting up of new communications links. In this case, expediently, the connection data to be transmitted are transmitted in blocks to the active peripheral assembly. One major advantage of this development is that, as soon as it is confirmed which peripheral assembly will be taking over or continuing the active operation after the occurrence of the fault, new communications links can be set up, and in this case it is possible to use the same method as that for fault-free operation.

The fault reversion according to the present invention can also be carried out in a corresponding manner for other types of peripheral assemblies for a switching device.

With regard to the apparatus, the central control unit of the switching device has a data memory in which connection data can be stored from signaled subscriber connections which are switched via the associated peripheral assemblies, and in that a transmission unit is provided for reading and transmitting the connection data to the associated peripheral assemblies.

Although modifications and changes may be suggested by those skilled in the art to which this invention pertains, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications that

may reasonably and properly come under the scope of their contribution to the art. - -

~~{Description}~~ **[Substitute Specification:]**

~~{Fault reversion in a switching device of a communications system}~~**[- - METHOD AND APPARATUS FOR FAULT REVERSION]**
~~{The invention relates to a method }~~**[IN A COMMUNICATIONS SYSTEM SWITCHING DEVICE**

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention pertains to a method and apparatus] for reversion of a fault in an active peripheral assembly of a switching device in a ~~{communications system, in particular }~~**[communi-cations system. In particular, the present invention pertains to a method and apparatus for reversion of a fault in an active peripheral assembly of a switching device]** in an ATM (Asynchronous Transfer Mode) communications system~~{, in which at least one signaled communications link is switched via the active peripheral assembly, and in which connection data for the communications link are stored in the active peripheral assembly in order to handle the communications link. The invention furthermore relates to a switching device for a communications system, in particular for an ATM communications system, having a central control unit for controlling a number of associated peripheral assemblies via which communications links can be switched.}~~**[.**

Discussion of the Related Art:]

It is known in switching devices of communications systems for communications links to be switched via peripheral assemblies of a switching device, that is to say to handle the communications links with the aid of hardware components of the peripheral assemblies, in particular to set up, to maintain and to end such links. Furthermore, it is known for a number of peripheral assemblies to be controlled via a central switching-internal computer. The central computer transmits, in particular, signals relating to the setting up and clearing of communications links, to the peripheral assemblies.

From ATM communications technology, it is known for permanent and signaled communications links to be set up and to be maintained. The permanent communications links

are normally set up and maintained over lengthy time periods by the operator of a communications system. Permanent communications links are subject to particularly stringent reliability requirements.

Signaled communications links are produced on request by the operator or by a user of the communications system and, as a rule, are maintained for shorter time periods than the permanent communications links. For example, a signaled communications link is ended when a telephone handset is placed on the rest. A typical feature of a signaled communications link is that it is left to the communications system to decide which chain of a number of possible physical path elements for transmission of communications signals will be set up for the signaled communications link.

~~{It is furthermore}~~ **[Furthermore, it is]**known for signaled permanent communications links to be set up and ~~{to be}~~ maintained over a similarly lengthy time period as permanent communications links. Signaled permanent communications links are subject to similarly stringent reliability requirements as **[are]** permanent communications links. In contrast to permanent communications links, the operator or a user of ~~{the}~~ **[a signaled permanent communications link]** communications system specifies only some of the nodes in the communications system and/or only some of the physical transmission sections, via which the communications link is intended to be set up~~{, when}~~**[.**

Apart from this,] setting up **[of]** a signaled permanent communications link~~{. Apart from this, the setting up of a signaled permanent communications link}~~ is left to the communications system. As in the case of signaled communications links ~~{as well}~~, signaled permanent communications links require additional connection data and/or connection data of a different type to be stored, in comparison with the data for permanent communications links, in order to handle the communications links.

In order to allow faults in an active peripheral assembly to be reversed, ~~{it is known for}~~ redundant peripheral assemblies and/or redundant transmission paths **[need]** to be provided. If a peripheral assembly or a transmission path fails, the communications link or ~~{the communications}~~ links ~~{is or}~~ are routed to the redundant peripheral assembly and/or

transmission path. In this case, a distinction is drawn between different types of redundancy. For example, peripheral assemblies may have so-called 1+1 redundancy or 1:N redundancy.

In the case of 1+1 redundancy, a passive peripheral assembly is provided for an individual active peripheral assembly and is available exclusively as a standby assembly for that active peripheral assembly. In consequence, the passive, redundant assembly may contain essentially the same hardware and software settings as the active assembly. In practice however, the software settings in particular, ~~{that is to say, for example, the}~~ **[such as]** connection data stored in the assembly, change at short time intervals. The software for the passive, redundant assembly is thus not reliably at the latest standard, so that it is not possible to switch over from the active assembly to the passive assembly without updating the software and/or the connection data. **[**

]Furthermore, there is no assurance that the same hardware settings would exist at the same time in both assemblies. For this reason, loss of all the signaled communications links must be expected if it is also possible for some of these signaled communications links to be maintained.

~~{Furthermore}~~ **[Therefore]**, when switching over from an active transmission path to a 1+1 redundant transmission path, it may be necessary to switch a number of peripheral assemblies which each have 1+1 redundancy. This increases the probability that the majority, or all the signaled communications links, will be lost.

In the case of 1:N redundancy, there is only one joint redundant assembly where the number of assemblies is N > 1. Presets in the redundant assembly, which speed up switching from one of the N active assemblies to the redundant assembly, which ensure that existing signaled communications links are maintained, thus cannot be carried out, or can be carried out only to a limited extent, according to the known method.

When software faults occur in an active peripheral assembly, ~~{it is known for}~~ the entire assembly **[may need]** to be reset and ~~{to be}~~ restarted. In the process, all the connection data for signaled communications links are deleted, so that all these communications links are terminated.

~~The present invention is based on the object of specifying a method for reversion of a fault in an active peripheral assembly of the type mentioned initially, in which stable signaled communications links can be reliably maintained after the occurrence of the fault. A further object of the invention is to specify a corresponding switching device. The objects are respectively achieved by a method having the features of claim 1, and by an apparatus having the features of claim 10. Developments are the subject matter of the dependent claims.~~

~~With regard to the method, the connection data for the at least one communications link, which data are stored in the active peripheral assembly, are also stored elsewhere in a redundant manner. After the occurrence of the fault, the connection data which are stored elsewhere in a redundant manner are used in order to continue to handle the communications link. The storage of two up-to-date sets of connection data ensures that the connection data are still available, at least once, after the failure or after the occurrence of the fault in the active peripheral assembly. Provided the redundant set of connection data, or at least one of the redundant sets of connection data, is or are undamaged after the occurrence of the fault, the undamaged data set can be used to continue to handle the communications link. It is thus possible to maintain the at least one signaled communications link, provided it is still stable after the occurrence of the fault. In order to preclude the possibility of the set of data which is stored in the faulty peripheral assembly being damaged and thus endangering the maintenance of the at least one communications link when it is used further, the connection data stored in the faulty peripheral assembly are preferably deleted.~~

~~The method according to the invention has the advantage that signaled communications links can be maintained with the same reliability as permanent communications links, which may be unstable in the same way as the signaled communications links after the occurrence of the fault, or can no longer be maintained owing to the fault.~~

~~The term peripheral assembly means an assembly or unit of a switching device which is directly involved in the setting up and/or in the maintenance of a communications link. The~~

~~term peripheral assemblies covers, in particular, interface assemblies (Line Interface Cards LIC), which form an interface to transmission lines outside the switching system, multiplexer units (for example Statistical Multiplexing Units SMU) which connect a number of interface assemblies to a switching network, switching networks (ATM Switching Networks ASN) which produce the correct output from a number of possible outputs in response to signals arriving at them. In particular, the assemblies have a large number of elements which carry out functions on the assembly, but at least a memory area for storing the connection data and an element which is directly involved in the communications link. The invention can also be used in other communications system, for example in STM (Synchronous Transfer Mode) communications systems.~~

~~In a communications system, the term switching device means a device which allows various switching system external and/or switching system internal transmission paths or transmission lines to be connected to one another or to be enabled for the purposes of setting up a communications link.~~

~~The term communications link means a link for connection of any desired type via which signals can be transmitted within the communications system or beyond the boundaries of the communications system.~~

~~The connection data are preferably stored in a memory device which is central for the number of peripheral assemblies, before the fault occurs. In particular, the memory device is part of a central switching computer of the switching device. In this case, the switching computer may, for example, update that copy of the connection data which is stored in its memory device whenever it informs the active peripheral assembly of changes which relate to the connection data.~~

~~However, on the other hand, as well, the central memory for the connection data for a number of peripheral assemblies has the advantage that one common memory unit or memory device is sufficient, and that the data administration can be carried out in an effective manner.~~

~~In one development, a redundant passive peripheral assembly, in which the connection data are stored in a redundant manner, is provided for the active peripheral assembly. In contrast to the prior art, the passive peripheral assembly is used to store a set of connection data which is just as up-to-date as that in the active peripheral assembly. This firstly creates the possibility simply of switching over to the passive peripheral assembly after the occurrence of the fault in the active peripheral assembly while, on the other hand, it is possible to transmit the connection data from the passive peripheral assembly to the active peripheral assembly, for example if the connection data stored in the active peripheral assembly are faulty, or there is a possibility of such data being faulty.~~

~~If a fault occurs in the software of the active peripheral assembly, the connection data which are stored elsewhere in a redundant manner can be transmitted, in a preferred manner, to the peripheral assembly which is still active after the occurrence of the fault. Faults in software covers not only faults in programs, but also faults in stored data to which access can be made while a program is running.~~

~~In many fault situations, continuation of operation of the active peripheral assembly represents the fastest and most reliable option for maintaining stable communications links without considerable interruptions. Mostly, hardware settings still exist in the active peripheral assembly in order to maintain a communications link after the occurrence of the fault. This is preferably checked after the transmission of the connection data stored elsewhere in a redundant manner, or at least after transmission of some of these connection data items. During the check it is also, for example, possible to confirm whether the connection data stored elsewhere in a redundant manner have been changed as a consequence of their having been updated in the meantime, so that corresponding corrections or changes are required to the hardware settings. One possible reason for this occurs when a message that the communications link is intended to be ended arrives at a central switching computer in the meantime.~~

~~In one preferred refinement of the method, the connection data to be transmitted remain stored at the other location, that is to say they are transmitted in the form of a copy. This~~

~~also applies in particular to the situation in which, after the occurrence of the fault, the previously active peripheral assembly becomes passive and a redundant assembly is used as the active peripheral assembly, to which the connection data stored elsewhere in a redundant manner are transmitted. This method variant makes it possible to maintain stable communications links in particular when hardware faults occur in the previously active peripheral assembly.~~

~~In one particularly preferred development of the method, the transmission of the connection data to the peripheral assembly which is active after the occurrence of the fault is interrupted, or is not started until later, in order to allow the setting up of new communications links. In this case, expediently, the connection data to be transmitted are transmitted in blocks to the active peripheral assembly. One major advantage of this development is that, as soon as it is confirmed which peripheral assembly will be taking over or continuing the active operation after the occurrence of the fault, new communications links can be set up, and in this case it is possible to use the same method as that for fault-free operation.~~

~~With regard to the apparatus, the object of the invention as stated above is achieved in that the central control unit of the switching device has a data memory in which connection data can be stored from signaled subscriber connections which are switched via the associated peripheral assemblies, and in that a transmission unit is provided for reading and transmitting the connection data to the associated peripheral assemblies.~~

~~Advantages and developments result from the above description of the method according to the invention, and its developments.~~

~~Exemplary embodiments of the invention will now be described with reference to the attached drawing. However, the invention is not limited to these exemplary embodiments.~~

~~The single figure of the drawing, which is annotated Figure 1, shows:~~

~~a switching device having two 1+1 redundant interface assemblies during reversion of a fault.~~

~~The switching device EXC (shown in Figure 1) of a communications system)~~ [SUMMARY OF THE INVENTION

It is an object of the invention to provide a method and apparatus for reversion of a fault in a communications system.

It is another object of the invention to provide a method and apparatus in which stable signaled communications links in a communications system can be reliably maintained after the occurrence of a fault.

It is a further object of the invention to provide a method and apparatus for specifying a corresponding switching device in a communications system after the occurrence of a fault.

It is an additional object of the invention to provide a method and apparatus in an ATM (Asynchronous Transfer Mode) communications system in which at least one signaled communications link is switched via an active peripheral assembly after the occurrence of a fault.

It is yet another object of the invention to provide a method and apparatus in which connection data for communications link on a communications system are stored in an active peripheral assembly.

It is yet a further object of the invention to provide a method and apparatus for an ATM communications system having a central control unit and a number of associated peripheral assemblies via which communications links can be switched.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a switching device according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a switching device EXC having two 1+1 redundant interface assemblies according to the present invention.

The switching device EXC] has two interface assemblies LICI, LIC2 which are 1+1 redundant with respect to one another. A large number of communications links are set up, maintained and/or ended via the respective active interface ~~{assembly}~~ **[assemblies]** LICI, LIC2. For this purpose, connections ~~{(which are}~~**[(]**not shown) of the interface assemblies LICI, LIC2 ~~{are connected}~~ **[is made]** to external subsections ~~{(which are likewise}~~**[(]**not shown) of transmission lines for transmission of communications signals. **[**

]Within the switching system, the **[active]** interface assemblies LIC1, LIC2 are connected to additional assemblies ~~{(which are also}~~**[(]**not shown) of the switching device EXC.

~~{The communications}~~ **[Communications]** signals arriving at and/or departing from the active interface assembly LICI, LIC2 can be transmitted on defined sections of communications lines via these assemblies, for example**[,]** multiplexer assemblies, switching network assemblies and other interface assemblies.

~~{The fault reversion described in the following text can also be carried out in a corresponding manner for the said types and further types of peripheral assemblies for a switching device. In a first exemplary embodiment for fault reversion, }~~**[In a first type of fault reversion, let's say]** a software fault has occurred in the peripheral assembly LIC2. In order to circumvent the fault, the interface assembly LIC2 is reset, and all the data ~~{that are not}~~ stored in permanent memories ~~{are}~~ **[is]** lost.

This effect is desirable since it ensures that faulty data are deleted. The effort for precise localization of faulty components of data which are not faulty overall is generally considerably greater than this.

After ~~{the}~~ resetting of the interface assembly LIC2, basic data are first of all transferred or transmitted from a database manager DBMS of a central switching computer MP to a database CDB of the interface assembly LIC2. In the process, it is possible to transmit, in particular, data for programs which are used to carry out the functions of the peripheral assembly LIC2. Alternatively or additionally, a permanent memory, for example an ~~{FEPROM}~~ **[EEPROM]**, is provided in the peripheral assembly LIC2, in which program data are stored and from which, after

resetting, data are copied to a volatile memory, for example a RAM, which contains the database CDB.

~~{It has already been proposed that, in method step a, data be transmitted from permanent communications links to the interface assembly LIC2 which are}~~ **[The method steps of the present invention for reversion of a fault in an active peripheral assembly LIC1or LIC2 of a switching device EXC in a communication system include, switching at least one signaled communications link via the active peripheral assemblies LIC1, LIC2, storing connection data for the communications link in the active peripheral assemblies LIC1, LIC2 in order to handle the communications link, and transmitting to the active peripheral assemblies LIC1, LIC2 connection data stored in a switching data manager RHS after occurrence of the fault.**

The data manager RHS is central to a number of peripheral assemblies LIC1, LIC2, and the connection data held by the memory devices RHS is] stored in a redundant manner**[.**

According to the method of the present invention, transmission of the connection data can be interrupted or started at a later time, in order to allow the setting up of new communications links.

Data is transmitted from permanent communications links to the interface assembly LIC2 which are stored in a redundant manner] in the central switching computer MP. ~~{It is also known, once method step a has been carried out, for hardware}~~ **[Hardware]** settings relating to the connection hardware ASIC of the interface assembly LIC2 ~~{to}~~ **[can]** be checked for consistency with the data of the permanent communications links, and for any corrections which may be necessary to the hardware settings to be carried out. The connection manager COH of the interface assembly LIC2 is involved in this activity, in that it reads the data from the database CDB and carries out the appropriate test steps.

~~{Now, in method step b, connection}~~ **[Connection]** data, which are stored in a redundant manner in the central switching computer MP, for the signaled communications links are transmitted to the interface assembly LIC2, which is being or has been maintained with the aid of the connection hardware ASIC in the interface assembly LIC2.

In the process, it is possible for individual signaled communications links, or for a number of signaled communications links, to be interrupted or terminated as a result of the fault which has occurred. ~~{In method step b, a)~~ **[A]** switching data manager RHS in the central switching computer MP transmits the connection data for the signaled communications links to the connection manager COR in the interface assembly LIC2. In the process, the connection data are transmitted in data blocks of predetermined length. It takes the connection manager COH a period of 5ms, for example, to receive a data block, with connection data being received for about 30 signaled communications links for the interface assembly LIC2. **[**

]After reception of the data block, the connection manager COH starts to check the hardware settings of the corresponding communications links, which are carried out in the connection hardware ASIC~~{(method step d)}~~. It takes the connection manager COH, for example, about half a second to read the connection data and to check them for consistency with the hardware settings for about 30 communications links.

~~{Method step b' is carried out in parallel with method step b). In method step b', the}~~ **[The]** connection manager COH is informed by the connection data manager RHS when a request to set up a new communications link is present in the central switching computer MP. Before the transmission of the first data block ~~{in method step b}~~, or between the transmission of two data blocks, the connection manager COH reacts to the request by setting up a new communications link on the basis of the connection data which it receives from the ~~{connection}~~ data manager RHS together with the information about the presence of the request. **[**

]The new communications link may be a signaled communications link or a non-signaled communications link. Corresponding procedures are used in the presence of requests to set up a number of new communications links. In this case, the corresponding data can be transmitted individually or in blocks to the connection manager COH. The requests for new communications links preferably have priority over the checking of the hardware settings of already existing communications links, so that they are processed with priority by the connection manager COH. Furthermore, however, a time interval of predetermined length is preferably provided after which, at the latest, the connection manager COH again receives connection data from existing

communications links, or continues with checking the hardware settings of communications links whose connection data it already has. ~~{For example, during}~~ **[During]** operation of communications systems in practice, it is accepted that the setting up of requested new communications links in a peripheral assembly will be delayed by around 500ms. **[**

]As described above, the connection data for approximately 30 already existing communications links~~{, for example,}~~ can be read and the corresponding hardware settings checked within 500ms. The checking of the hardware setting is annotated in Figure 1 by the reference symbol d, and the resetting of communications links in the connection hardware HSIC is annotated by the reference symbol d'.

Before, during and after reception of connection data for already existing communications links and/or reception of connection data of communications links to be set up as new, a start pulse for a time-interval measurement for connection-duration-dependent charges is in case issued, in a development of the invention. If the connection manager COH has the respective connection data for such a communications link, it sends the start pulse to the charge meter TM which is provided in the interface assembly LIC2. The transmission of the charge-meter start pulse for already existing communications links is illustrated as method step c, and the corresponding transmission of a start pulse for a communications link which is to be set up as new is shown as method step c'.

In ~~{yet}~~ another ~~{development of the exemplary}~~ embodiment described with reference to Figure 1 ~~{for the method according to the invention}~~, the central switching computer MP transmits a request to the connection manager CON to terminate an existing communications link~~{, in a method step (which is not shown) after method step a. However, in the development of the exemplary embodiment,}~~**[**.

However,]the charge-meter start pulse according to method step c has not yet been transmitted from the connection manager CON to the charge meter TM at this time. The connection manager COH thus does not confirm the request, and does not act on this request either. This ensures that the charge meter TM can determine the connection-duration-dependent charges correctly and does not receive a charge-meter stop pulse before receiving a charge-

meter start pulse for an existing communications link. Since the central switching computer MP have not received any confirmation from the connection manager COH, it repeats the transmission of the request to terminate the communications link, preferably at time intervals which are fixed in advance. In the meantime, for example between the first and the third transmission of the request, the connection manager COH will have received the connection data for the relevant communications link, and will have sent a corresponding charge-meter start pulse to the charge meter TM. [

]This ~~{thus}~~ acknowledges the third request with a confirmation, sends a charge-meter stop pulse to the charge meter TM, and terminates the communications link by making appropriate hardware settings in the connection hardware ASIC.

In the ~~{exemplary embodiment}~~ **[embodiments]** described so far, it has been assumed that there has been a software fault in the interface assembly LIC2. The same method, together with its development~~{,}~~ can~~{, however,}~~ be applied, for example, to a situation in which a hardware fault has occurred in the previously active interface assembly LICI and the 1+1 redundant interface assembly LIC2 has taken over the active function from the interface assembly LICI. Furthermore, ~~{the same refinements of}~~ the method can be used in situations in which there is no redundant component or in which 1:N redundancy exists. Overall, a universal method is thus available for reversion of a fault in an active peripheral assembly in a switching device, which allows all those communications links which are stable after the occurrence of the fault to be maintained while having to accept, at worst, only short interruption times. Furthermore, the universal method ensures the setting up of communications links as new with the least possible time delay while reliably deleting all possibly faulty data in the assembly.

[According to the present invention, connection data for at least one communications link, which data are stored in the active peripheral assembly, are also stored elsewhere in a redundant manner. After the occurrence of the fault, the connection data which are stored elsewhere in a redundant manner are used in order to continue to handle the communications link. Storage of two up-to-date sets of connection data ensures that the connection data are still available, at least once, after the failure or after

the occurrence of the fault in the active peripheral assembly. Provided the redundant set of connection data, or at least one of the redundant sets of connection data, is or are undamaged after the occurrence of the fault, the undamaged data set can be used to continue to handle the communications link.

It is thus possible to maintain the at least one signaled communications link, provided it is still stable after the occurrence of the fault. In order to preclude the possibility of the set of data which is stored in the faulty peripheral assembly being damaged and thus endangering the maintenance of the at least one communications link when it is used further, the connection data stored in the faulty peripheral assembly are preferably deleted.

According to the present invention, signaled communications links can be maintained with the same reliability as permanent communications links, which may be unstable in the same way as the signaled communications links after the occurrence of the fault, or can no longer be maintained owing to the fault.

The present invention can also be used in other communications system, for example in STM (Synchronous Transfer Mode) communications systems.

The term peripheral assembly means an assembly or unit of a switching device which is directly involved in the setting up and/or in the maintenance of a communications link. The term peripheral assemblies covers, in particular, interface assemblies (Line Interface Cards LIC), which form an interface to transmission lines outside the switching system, multiplexer units (for example Statistical Multiplexing Units SMU) which connect a number of interface assemblies to a switching network, switching networks (ATM Switching Networks ASN) which produce the correct output from a number of possible outputs in response to signals arriving at them. In particular, the assemblies have a large number of elements which carry out functions on the assembly, but at least a memory area for storing the connection data and an element which is directly involved in the communications link.

In a communications system, the term switching device means a device which allows various switching-system-external and/or switching-system-internal transmission paths or transmission lines to be connected to one another or to be enabled for the purposes of setting up a communications link.

The term communications link means a link for connection of any desired type via which signals can be transmitted within the communications system or beyond the boundaries of the communications system.

The connection data are preferably stored in a memory device which is central for the number of peripheral assemblies, before the fault occurs. In particular, the memory device is part of a central switching computer of the switching device. In this case, the switching computer may, for example, update that copy of the connection data which is stored in its memory device whenever it informs the active peripheral assembly of changes which relate to the connection data.

However, the central memory for the connection data for a number of peripheral assemblies has the advantage that one common memory unit or memory device is sufficient, and that the data administration can be carried out in an effective manner.

In one development, a redundant passive peripheral assembly, in which the connection data are stored in a redundant manner, is provided for the active peripheral assembly. In contrast to the prior art, the passive peripheral assembly is used to store a set of connection data which is just as up-to-date as that in the active peripheral assembly. This firstly creates the possibility simply of switching over to the passive peripheral assembly after the occurrence of the fault in the active peripheral assembly while, on the other hand, it is possible to transmit the connection data from the passive peripheral assembly to the active peripheral assembly, for example if the connection data stored in the active peripheral assembly are faulty, or there is a possibility of such data being faulty.

If a fault occurs in the software of the active peripheral assembly, the connection data which are stored elsewhere in a redundant manner can be transmitted, in a preferred

manner, to the peripheral assembly which is still active after the occurrence of the fault. Faults in software covers not only faults in programs, but also faults in stored data to which access can be made while a program is running.

In many fault situations, continuation of operation of the active peripheral assembly represents the fastest and most reliable option for maintaining stable communications links without considerable interruptions. Mostly, hardware settings still exist in the active peripheral assembly in order to maintain a communications link after the occurrence of the fault. This is preferably checked after the transmission of the connection data stored elsewhere in a redundant manner, or at least after transmission of some of these connection data items.

During the check it is also, for example, possible to confirm whether the connection data stored elsewhere in a redundant manner have been changed as a consequence of their having been updated in the meantime, so that corresponding corrections or changes are required to the hardware settings. One possible reason for this occurs when a message that the communications link is intended to be ended arrives at a central switching computer in the meantime.

Connection data to be transmitted remains stored at the other location, that is to say they are transmitted in the form of a copy. This also applies to situations in which, after the occurrence of the fault, previously active peripheral assembly become passive and a redundant assembly is used as the active peripheral assembly, to which the connection data stored elsewhere in a redundant manner are transmitted. Thus, it is possible to maintain stable communications links in particular when hardware faults occur in the previously active peripheral assembly.

Transmission of the connection data to the peripheral assembly which is active after the occurrence of the fault is interrupted, or is not started until later, in order to allow the setting up of new communications links. In this case, expediently, the connection data to be transmitted are transmitted in blocks to the active peripheral assembly. One major advantage of this development is that, as soon as it is confirmed which peripheral

assembly will be taking over or continuing the active operation after the occurrence of the fault, new communications links can be set up, and in this case it is possible to use the same method as that for fault-free operation.

The fault reversion according to the present invention can also be carried out in a corresponding manner for other types of peripheral assemblies for a switching device.

With regard to the apparatus, the central control unit of the switching device has a data memory in which connection data can be stored from signaled subscriber connections which are switched via the associated peripheral assemblies, and in that a transmission unit is provided for reading and transmitting the connection data to the associated peripheral assemblies.

Although modifications and changes may be suggested by those skilled in the art to which this invention pertains, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications that may reasonably and properly come under the scope of their contribution to the art. - -]

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY – CHAPTER II

REQUEST FOR APPROVAL OF DRAWING CHANGE

APPLICANT(S):	WOLLENWEBER, J., et al.
ATTORNEY DOCKET NO:	P00,1979
INTERNATIONAL APPLICATION NO:	PCT/DE99/02578
INTERNATIONAL FILING DATE:	17 AUG 1999
INVENTION:	ERROR CANCELLATION IN THE SWITCHING DEVICE OF A COMMUNICATION SYSTEM

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Applicants herewith request approval of the change to Figure 1, as shown in red, on the drawing sheet attached hereto, in the above-referenced PCT application.

Respectfully submitted,

Steven H. Noll (Reg. No. 28,982)

SCHIFF, HARDIN & WAITE
Patent Department
6600 Sears Tower
233 South Wacker Drive
Chicago, IL 60606
Telephone (312) 258-5790
Attorney for Applicant(s)
CUSTOMER NUMBER 26574

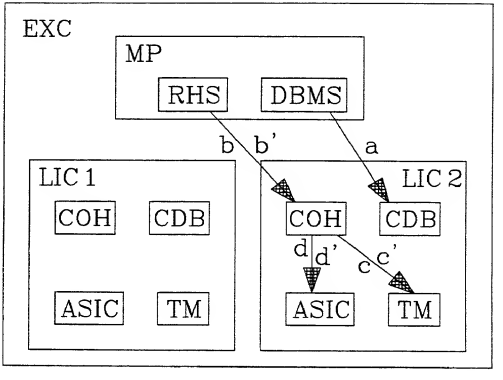
EXC
MP
RHS
DBMS
b
b'
a
LIC 1
LIC 2
COH
CDB
COH
CDB
d
d'
c
c'
ASIC
TM
ASIC
TM

Fig.1

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY – CHAPTER II

SUBMISSION OF DRAWINGS

APPLICANT(S):	WOLLENWEBER, J., et al.
ATTORNEY DOCKET NO:	P00,1979
INTERNATIONAL APPLICATION NO:	PCT/DE99/02578
INTERNATIONAL FILING DATE:	17 AUG 1999
INVENTION:	ERROR CANCELLATION IN THE SWITCHING DEVICE OF A COMMUNICATION SYSTEM

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Applicants herewith submit one drawing sheet, showing Figure 1, in the above-referenced PCT application.

Respectfully submitted,

Steven H. Noll (Reg. No. 28,982)

SCHIFF, HARDIN & WAITE
Patent Department
6600 Sears Tower
233 South Wacker Drive
Chicago, IL 60606
Telephone (312) 258-5790
Attorney for Applicant(s)
CUSTOMER NUMBER 26574

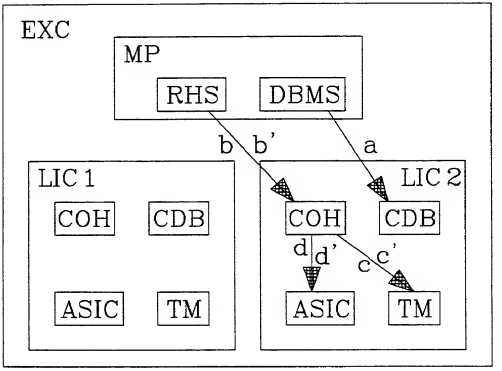
EXC
MP
RHS
DBMS
b
b'
a
LIC 1
LIC 2
COH
CDB
COH
CDB
d
d'
c
c'
ASIC
TM
ASIC
TM

Fig.1

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Fehlerbehebung in einer Vermittlungseinrichtung eines Kommunikationssystems

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

(check one)

☐ is attached hereto.

☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1 56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign applications Priorität beansprucht			Priority Claimed
198 37 216.7 (Number) (Nummer)	Germany (Country) (Land)	17. August 1998 (Day Month Year Filed) (Tag Monat Jahr eingereicht)	☒ Yes Ja ☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja ☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja ☐ No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842) Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I. Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

312/876-0200
Ext. _____

Postanschrift:

Send Correspondence to:

HILL, STEADMAN & SIMPSON
A Professional Corporation
85th Floor Sears Tower, Chicago, Illinois 60606

Voller Name des einzigen oder ursprünglichen Erfinders: WOLLENWEBER, Johannes	Full name of sole or first inventor:
Unterschrift des Erfinders: Datum 12.8.99	Inventor's signature Date
Wohnsitz D-82377 Penzberg, Germany	Residence
Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Karlstr. 43 D-82377 Penzberg Bundesrepublik Deutschland	Post Office Addess
Voller Name des zweiten Miterfinders (falls zutreffend): STELZL, Rudolf	Full name of second joint inventor, if any:
Unterschrift des Erfinders: Datum 10.8.99	Second Inventor's signature Date
Wohnsitz D-85221 Dachau, Germany	Residence
Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship
Postanschrift Pfarrer Lechner Weg 4 D-85221 Dachau Bundesrepublik Deutschland	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).